notation. Lastly the price and bulk of this book are too great in respect of its utility." *Brunet* says this Edition of 1760.

The Rev. Theaker Wilder's Edition; translated by Ralphson, revised and corrected by Cunn; to which is added a treatise upon the measure of ratios by James Maguire. London, 1769. Wilder succeeded Maguire as Professor of Mathematics at Trinity College, Dublin: took the pecuniary risk of the publication, and gave the profits to Maguire's representatives.

Editio, commentariis illustrata et aucta a J. A. Lecchi. Milan, 1752, 8vo. 3 vols.

Arithmetique Universelle, traduit du Latin, avec des notes par Noel Beaudeux. Paris, 1802: 4to; 2 vols.

Mr. Wilder mentions, Reyneau, Bernouilli, Maclaurin, Coleson and Campbell as among those persons who had illustrated some particular parts of the work.

The Universal Arithmetic deserves an American Edition, with notes and comments by some mathematician of ability.

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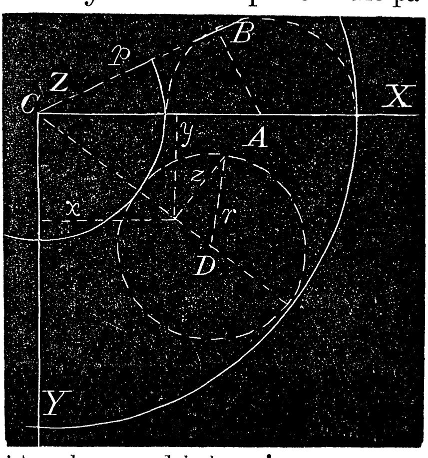
## *THE SECTION OF A CIRCULAR TORUS BY A PLANE PASSING THROUGH THE CENTER AND TANGET AT OPPOSITE SIDES.*

BY PROF. E. W. HYDE, CIN. UNIV., CINCINNATI, OHIO.

IN the diagram suppose the axes of $x$ and $y$ to be in the plane of the paper, and the axis of $z$ perpendicular to the same.




For any point of the surface we shall have $x^2 + y^2 = \rho^2$, and $\rho = R - \sqrt{(r^2 - z^2)}$, in which $R = AC$ and $r = AB$.

$\therefore\ x^2 + y^2 = R^2 - 2R\sqrt{(r^2 - z^2)} + r^2 - z^2$, whence by transposing, squaring, reducing and placing $R^2 - r^2 = p^2$ and $R^2 + r^2 = q^2$ we obtain $(x^2 + y^2 + z^2)^2 - 2q^2(x^2 + y^2) + 2p^2z^2 = -p^4$.

The equation of a plane through the axis of $y$ and tangent on the opposite sides above and below, is

$$z = \frac{rx}{\sqrt{(R^2 - r^2}} = \frac{r}{p}x.$$

Eliminating between the equation of the torus and that of the plane, we obtain $\left(x^2 + y^2 + \dfrac{r^2}{p^2}\,x\right)^2 - 2q^2(x^2 + y^2) + 2r^2x^2 = -\,p^4,$

which by expansion and reduction becomes

$$(R^2x^2 + p^2y^2)^2 - 2R^2p^4x^2 - 2p^4q^2y^2 = -\,p^8.$$

This is the equation of an oblique projection of the intersection .To obtain the curve in its own plane, we must substitute for $x$, $x'$ cos (angle between tangent plane and plane $x\ y) = (p \div R)x'$. Therefore

$$p^4(x'^2 + y^2)^2 - 2p^6x'^2 - 2p^4q^2y^2 = -\,p^8,$$

or, dividing by $p^4$ and dropping primes,

$$(x^2 + y^2)^2 - 2p^2x^2 - 2q^2y^2 = -\,p^4.$$

Add to both sides of this equation $2p^2(x^2 + y^2)$, then

$$(x^2 + y^2)^2 - 2p^2x^2 - 2q^2y^2 + 2p^2x + 2p^2y^2 = 2p^2(x^2 + y^2) - p^4$$

or $$(x^2 + y^2)^2 - 2y^2(q^2 - p^2) = 2p^2(x^2 + y^2) - p^4$$

$$(x^2 + y^2)^2 - 2y^2(R^2 + r^2 - R^2 + r^2) = 2p^2(x^2 + y^2) - p^4$$

$$(x^2 + y^2)^2 - 2p^2(x^2 + y^2) + p^4 = 4r^2y^2.$$

$\therefore$ $$x^2 + y^2 - p^2 = \pm\, 2ry;$$

$\therefore$ $$x^2 + y^2 \pm 2ry + r^2 = R^2,$$

and $$x^2 + (y \pm r)^2 = R^2.$$

Hence the section is two circles whose radius is $R$, and whose centers are at a distance from the center of the torus equal to the radius of the generating circle of the torus.

In a similar manner we find that when the generating curve is an ellipse, the section is two ellipses whose semi axes are $R$ and $\surd(R^2 - a^2 + b^2)$, $a$ and $b$ being the semi axes of the generating ellipse. So with a hyperbolic generatrix, we obtain hyperbolas whose semi axes are $R$ and $\surd(R^2 - a^2 - b^2)$. In this case we must have $a > R$ in order to render the problem possible. With parabolic generatrix we have a parabola whose parameter (latus rectum) is $4(R + p)$,* that of the generatrix being $4p$. With the conjugate hyperbola for generatrix the section is *imaginary*, the equation of its projection being $R^2x^2 + (R^2 + a^2)(y \mp a\surd{-1})^2 = R^2(R^2 - a^2)$.

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## *DIFFERENTIATION.*

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BY J. B. MOTT, NEOSHO, MISSOURI.

HAVING seen several explanations of the method of finding the first differential coefficient, I offer the following:

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*In this case $R$ is the distance from the center of the torus to the vertex of the generating parabola.